

**An Evaluation Of The Wildland Air Attack
Program Utilized In The New Jersey Pine Barrens**

STRATEGIC MANAGEMENT OF CHANGE

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ABSTRACT

The New Jersey Forest Fire Service has long known the importance of utilizing aircraft in their annual battle with fast spreading wildfires in extremely hazardous forest fuels. The purpose of this project was to evaluate the air attack aircraft used to drop water during the 1999 spring fire season in New Jersey's central division whose primary forest fuels consist of the volatile Pine Barrens. The aircraft evaluated included the Ag Cat single engine air tanker, Dromader single engine air tanker and the Huey medium drop helicopter. Historical, descriptive and evaluative research methods were utilized to answer the following questions:

1. What historical changes in aircraft use have occurred in the NJFFS air attack program since its inception?
2. How do Forest Fire Service Field Fire Supervisors from the central division rate the different aircraft presently used for air attack?
3. At what stage of wildfire suppression is air attack most valuable?
4. What air resources should be included in the NJFFS central division's air attack program and which aircraft assignments are recommended for change?

Procedures used in the preparation of this research project

included historical, descriptive and evaluative research. An evaluation was conducted through the interview of field personnel that are responsible for the use and management of the above mentioned three air attack resources during wildfire incidents.

This research project determined that the use of air attack resources on wildfire incidents is most effective during the initial attack stages of the incident. Single engine air tankers appear best suited for initial attack fire assignments while medium drop helicopters are best suited for suppressing spot fires and providing fire suppression services during large extended attack wildfires. The aerial fire attack fleet that protects the Pine Barrens of central New Jersey should include a mix of single engine air tankers as well as medium drop helicopters.

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INTRODUCTION

The New Jersey Forest Fire Service (NJFFS) has been managing wildfires in New Jersey since its establishment in 1906. Wildfires of various sizes and complexities have threatened, damaged and destroyed people's homes and improved property as well as threatened, injured and taken human lives. The central division of the New Jersey Forest Fire Service protects 883,872 acres of extremely hazardous Pine Barrens forest areas with adjacent high population density areas. This high density of people within close proximity of the Pine Barrens allows for an increased demand for housing and more people moving from urban to wildland areas resulting in an ever increasing threat to life and property from the threat of wildfires (Forest Fire Service, 1997).

The Forest Fire Service has used air resources in managing wildfires since 1927. Air attack of wildfires with the actual dropping of water was first utilized in 1961. From 1961 through the present, the NJFFS has used different air resources to accomplish the mission of wildland fire aerial attack.

The purpose of this research project was to evaluate the various aircraft utilized during the 1999 spring fire season in the Pine Barrens region of Central New Jersey regarding their

aerial fire suppression performance and to determine how this information can be used to improve the air attack program.

Historical, descriptive and evaluative research methods were utilized to answer the following questions:

1. What historical changes in aircraft use have occurred in the NJFFS air attack program since its inception?
2. How do Forest Fire Field Fire Supervisors from the central division rate the different aircraft presently used for air attack?
3. At what stage of wildfire suppression is air attack most valuable?
4. What air resources should be included in the NJFFS central division's air attack program and which aircraft assignments are recommended for changes?

BACKGROUND AND SIGNIFICANCE

The potential for wildfire disasters in the New Jersey Pine Barrens has been historically demonstrated many times. Large conflagrations have occurred from the 1930's through the present. The most serious of these wildfires occurred during April of 1963 when wildfires destroyed 183,000 acres of forest, consumed 186 homes and 197 buildings and were responsible for the loss of seven human lives. One fire during this period advanced three and half miles in two hours and nine miles in six hours (Pyne, 1982). These potential wildfire hazards have been intermingled with a proliferation of residential subdivisions and developments into Pine Barrens areas with no consideration for forest fire protection measures (Forest Fire Service, 1997). In 1995, one wildfire consumed 19,225 acres while a 1997 800 acre blaze damaged 52 homes and threatened over 300 additional homes. Aviation resources have been an integral part of this battle against wildfires in New Jersey since 1927 when State Firewarden Coyle recognized the importance of aircraft and was one of the first in the country to utilize them in this capacity (Hughes, 1989).

The New Jersey Forest Fire Service Air Operations Manual clearly describes the primary objectives of their aviation program:

The aviation program is designed to increase the capabilities of the NJFFS in fire management and in the suppression of forest fires through the safe, efficient and timely use of aircraft. It must also be recognized that aircraft add another effective tool to the wildfire incident commander's equipment resources, and supplement, but do not replace ground based fire suppression resources (p.5).

All air attack programs must have as their primary goal the rapid attack of wildland fires with the ultimate objective of confining the fire by using a combination of ground and air resources (McFadden & Hawkins, 1996). Air attack is defined as an operation involving the use of aircraft as part of the fire suppression action (NFPA, 1991). Air attack resources include fixed wing as well as rotary wing aircraft which are used to support fire suppression efforts on the ground (Perry, 1986).

The use of aircraft in the aerial attack of wildfires has steadily increased and expanded both nationally and in New Jersey. During the 1999 spring fire season the NJFFS utilized two types of single engine air tankers and one helicopter as part of their air attack program. The use of aircraft in the future will only be limited by the imagination of fire managers who will use the most up to date technology to improve wildfire

suppression programs (Forest Fire Service, 1987).

Air attack programs have undergone changes in the past and will expand and change in the future. The Change Management Model, which was introduced during the Strategic Management Of Change course at the National Fire Academy can be utilized in managing and leading these changes. The Change Management Model consists of four phases which include analysis, planning, implementation and evaluation. Since this project will consist of an evaluation of the performance of the aircraft utilized by the NJFFS, only portions of the evaluation phase will be analyzed. The evaluation phase consists of three steps which include evaluation, modification and continuous monitoring (NFA, 1996).

LITERATURE REVIEW

Air Attack Overview

A wildland fire suppression system depends on how quickly it is able to react to the occurrence of a wildfire (Ragus, 1997). Resources need to be committed early on during a wildfire incident and the growth of small fires into large wildfires should be avoided whenever possible (Wells, 1996). Goodson

(1997) adds that the way wildland firefighters deal with small fires that have the potential to grow larger is of extreme importance. Wildland firefighters must hit small fires with everything they have in order to knock them out as quickly as possible.

In areas where fire occurrence is high, bigger isn't always better. A mixture of single engine air tankers and helicopters is necessary and each fire should dictate the right tool for the right job (Anderson, 1997). Air attack programs must consist of safe, effective and appropriate tactical uses of aviation resources (Chambers, 1995).

Clar and Chatten (1966) best describe the significance of aircraft use in the management of wildfires:

The development of aircraft to perform highly specialized firefighting jobs offers an unusual opportunity. But it also imposes an additional responsibility upon fire control personnel. The opportunity is presented in the form of a specialized fire attack system with capabilities which can't be matched by any other "tool". This dimension in fire control permits the attack forces to use strategies previously not possible. It also makes possible a more rapid adjustment to changing fire situations. The responsibility then follows that all fire control personnel

must learn the uses and limitations of each type of aircraft and the ways to effectively coordinate action which involves both air and ground forces (p. 123).

History Of Air Attack

Airplanes were first utilized by the United States Forest Service in 1919 as a fire prevention tool to aid in the detection of wildfires in the Western United States (Pyne, 1982). The New Jersey Forest Fire Service used airplanes in 1927 for airborne fire detection as well as observation of large wildfires for firefighting coordination (Hughes, 1989). Dudley and Greenhoe (1998) explain how helicopters were first used on a wildfire in Southern California in 1947. The helicopters initial assignments included transportation of food and firefighters as well as a fireline reconnaissance and mapping service.

The delivery of water to a wildfire by an airplane did not occur until the 1930's when the Johnson Flying Service of Montana dropped wooden barrels of water on a fire. Crop dusting airplanes were used as the first true air tankers in the late 1950's when water was actually dropped from a tank beneath the belly of the plane (McFadden & Hawkins, 1996). In 1961, the first water bomber utilized in New Jersey was a Steerman brand aircraft operating in the New Jersey Pine Barrens. Helicopters were also soon adapted for dropping water on wildfires from buckets and belly

tanks. Drop helicopters were used in the Pine Barrens in 1964 following the disastrous wildfire conflagrations of the previous year (Hughes, 1989). From the period of 1964 through 1982, the New Jersey Forest Fire Service utilized an assortment of rotary and fixed wing aircraft to fulfill the mission of aerial attack on wildfires. In 1982, the NJFFS switched to an entirely fixed wing air attack fleet until helicopters were reintroduced in 1992.

Fixed Wing Aircraft

Air tankers are an essential tool that are used by wildfire suppression agencies around the world. They are vital as an initial attack resource as well as a resource suppressing large wildland fires (Larson, 1995). Small air tankers can be used in an efficient and economical manner on wildfire suppression assignments when the fire is within thirty miles of their air attack base (NFPA, 1991). Key factors that make the air tanker a valuable resource include speed, mobility, accuracy and load capacity but the coordinated effort with ground forces is a requirement towards the success of the operation (Elias, 1984).

The two air tankers utilized by the NJFFS during 1999 can be considered as light air tankers and included the Grumman brand Ag - Cat which is capable of a maximum load of 300 gallons as well as the FLZ M18 Dromader which can carry 660 gallons of

water (NFPA, 1991). These able and agile aircraft are beginning to be involved in more assignments beyond initial attack fire suppression such as prescribed burning, reforestation and boundary management (Ghetia, 1995). Air tanker turn around time, which is defined as the amount of time it takes an air tanker to secure a load of water and get it back to the incident, should be less than thirty minutes. If the turnaround time exceeds this on an incident, additional air tankers should be utilized (Teie, 1994).

Rotary Wing Aircraft

In view of the growing need for aviation resources to supplement ground forces, air tankers can not do the job alone. A mix of aircraft including the use of helicopters may be required (Mack, 1999). The National Fire Protection Association (1991) introduces the role of the rotary wing aircraft in wildland fire suppression:

The helicopter has become a familiar multiuse firefighting aircraft in wildland fire suppression. The aircraft has become as necessary in today's fire suppression as hand tools, crews, tractors, smokejumpers, engines and air tankers (P. 295-28).

Helicopters must be available for rapid dispatch and have a short travel and turnaround time (Incoll, 1995). Multi role

helicopters are able to significantly increase the helicopter turnaround time on an incident (Alder, 1995). Helicopter drops should be limited to a five minute turnaround time unless other conditions such as incident remoteness, length of use or availability of other aircraft impact operations (NWCG, 1996).

PROCEDURES

Definition Of Terms

Air Attack. The deployment of fixed wing or rotary wing aircraft on a wildland fire, to drop retardant or extinguishing agents, shuttle and deploy crews and supplies, or perform aerial reconnaissance of the overall fire situation (NWCG, 1996).

Initial Attack. The actions taken by the first resources to arrive at a wildfire to protect lives and property, and prevent further extension of the fire (NWCG, 1996).

Spot Fire. Fire ignited outside the perimeter of the main fire by a firebrand.

Air Tanker. Fixed wing aircraft certified by the FAA as being capable of transport and delivery of fire retardant solutions (NWCG, 1996).

S.E.A.T. Single engine air tanker (Ghetia, 1995).

Dromader. Single engine P2L M-18 aircraft capable of

carrying 660 gallons of water as an air tanker (Ghetia,1995).

Ag-Cat. Single engine Grumman brand aircraft capable of carrying 300 gallons of water as an air tanker (NFPA,1991).

Huey. A medium size Bell helicopter capable of carrying a bucket which can drop 300 gallons of water (NFPA,1991).

Turnaround Time. The time used by an air tanker or helitanker to reload and return to the fire (NFPA,1991).

Research methodology

The desired outcome of this research was to evaluate the air attack program utilized in the central division of the New Jersey Forest Fire Service by conducting historical, descriptive and evaluative research. The 1999 air attack program consisted of four Ag Cat S.E.A.T.'s, one Dromader S.E.A.T. and one Huey drop helicopter. The historical research consisted of a literature review to understand the basics of air attack system on a national level and how this can be related to the air attack program administered by the New Jersey Forest Fire Service. The historical review of New Jersey Forest Fire Service Annual Reports also resulted in the development of a timeline which represents the changes that have taken place since the program's establishment. A summary which represents the changes made during the past fifteen years appears as Appendix C. Information

obtained from the literature review was later applied to the interview results in order to answer the research questions on a broader level than just a New Jersey viewpoint.

The descriptive and evaluative research consisted of interviews with the ten Field Forest Fire Supervisors who each administer a geographical portion of the central division of the Forest Fire Service. Each supervisor is responsible for all aspects of a forest fire management and fire suppression program for their assigned area which includes the supervision of air attack resources assigned to wildland fire incidents. These personnel were asked questions regarding the air attack program in a simple format by being able to choose an appropriate answer. Interview questions appear in Appendix A with the interview results appearing in Appendix B.

Assumptions and Limitations

The evaluation of the air attack program of the central division of the NJFFS only takes into account the judgement of the field fire supervisors based on their training, knowledge and experience on how effective these aircraft operated during their most recent fire assignments. The ten fire supervisors represent 100 % of the personnel who do this job assignment within the central division and all did participate in the interview process. The aircraft that were evaluated included

two types of single engine air tankers and one type of drop helicopter. The interview questions did not take into account the many factors which may limit the operation of all three types of aircraft. Some of these limiting factors include high winds, tall trees and powerlines, time of day, wildland fuels, fire behavior and extended turnaround times (Teie,1994). These limitations must also be integrated along with the fire supervisor's judgement. Economic and cost factors were also not utilized during any air attack program interviews or during the literature review.

The evaluation information based on the interviews assumes that all ten supervisors interviewed , supervised the same aircraft under the same exact natural and administrative conditions on identical wildfire incidents. This is not a valid assumption since every wildfire incident is different. During the comparison of the interview results, it became evident that 40 % of the personnel were not afforded the opportunity to manage the Dromader single engine air tanker and 10 % did not manage the huey drop helicopter.

RESULTS

Written evaluation results were developed to create an

initial evaluation of what Field Fire Supervisors think of the present air attack program since these are the Forest Fire Service personnel that manage air attack resources on a daily basis in the New Jersey Pine Barrens. These results are shown in Appendix B. Appendix C is comprised of a timeline showing what air attack resources have been utilized in the central division over the past fifteen years.

Answers to Research Questions

Research Question 1. Aircraft were first used in aerial bombing by the Forest Fire Service in 1961 with the introduction of the biwing Steerman single engine air tanker. In 1963, helicopters capable of dropping water were added to the aviation fleet. During the 1960's and 1970's, a combination of helicopters and air tankers comprised the Forest Fire Service air attack program (Hughes,1989).

A review of New Jersey Forest Fire Service Annual Accomplishment Reports from 1982 through 1998 revealed the following aircraft assignments within the central division. From 1982 to 1992, a fleet of five Ag Cat single engine air tankers provided the entire air attack resources for the central division. In 1992, a Jet Ranger helicopter capable of carrying a water bucket was added to the fleet to augment the capabilities of the single engine air tankers. In 1993, due to the success of

the Jet Ranger helicopter, a Huey helicopter was added to the fleet and has been an integral part ever since.

In 1999, a Dromader single engine air tanker replaced one of The Ag Cats to add additional capabilities to the air attack program. The current fleet consists of four Ag Cat single engine air tankers, one Dromader single engine air tanker and one Huey drop helicopter. It is clear that change has played a significant part of the growth and improvement of the air attack program.

Research Question 2. Forest Fire Field Supervisors from the central division of the NJFFS were given the opportunity to express their evaluation of the 1999 air attack fleet based on their knowledge, training and experience. The Huey drop helicopter received an overall excellent rating while the Ag Cat and Dromader received overall satisfactory ratings. The Dromader evaluation was not representative of all the supervisors interviewed since forty percent of them were not able to work with aircraft due to this being its first year as part of the air attack fleet.

The most effective use of air attack resources involves using the right aircraft to accomplish the right tactical objective (Perry, 1986). The availability of each resource also plays a significant role in assigning missions to aircraft. Teie

(1994) expresses that air tankers are very effective during initial attack operations while the helicopter can be considered a problem solver with its ability for close in tactical support on large fires and ability to easily contain spot fires.

70 % of the fire supervisors interviewed felt that the single engine air tanker (Ag Cat and Dromader) are best suited for initial attack fire suppression assignments. 60 % felt that the Huey drop helicopter is better suited for suppression operations on large extended attack wildfires and 80 % believed that the Huey drop helicopter is best suited for attacking and suppressing spot fires.

Research Question 3. In areas where wildland fires spread rapidly, it is important that some type of wildland fire control action is initiated within minutes after the fire is detected (Clar and Chatten, 1966). When a call is received, ground resources and air resources are simultaneously dispatched. The primary mission of the air attack aircraft is to contain a fire while it is still small and before the arrival of the first ground resources (Elias, 1984). The New Jersey Forest Fire Service Division B (central New Jersey) Forest Fire Control Plan specifies that when air tankers are operational, they will be dispatched to each reported wildfire within 15 miles of their base immediately following the initial wildland engine response.

Perry(1986) feels that air attack resources are most

effective when used as an initial attack resource. 80 % of the Forest Fire Service Field Fire Supervisors that were interviewed agreed with Perry that air attack is most effective when used during the initial attack stages of a wildfire. These results can be found in Appendix B. Initial attack can be summarized by stating that small initial attack fires require effective short range small capacity weapons. A combination of single engine air tankers and drop helicopters comprises a perfect air attack combination for jurisdictions with a large number of initial attack wildfire incidents (Anderson, 1997).

Research Question 4. Agricultural fixed wing aircraft and medium lift helicopters with buckets are a cost effective mix of aircraft for assisting with direct attack on developing fires (Incoll,1995). 90 % of the fire supervisors who were interviewed reported that the central division's air attack program should continue to consist of a mixture of Ag Cat and Dromader S.E.A.T.'s as well as the Huey drop helicopter.

A mix of air resources will not change the role of wildland fire aviation. The primary role of wildland fire aviation must always be to make the fire suppression job easier for the wildland firefighters on the ground (Mack, 1999). Alder (1995) adds that medium lift helicopters and single engine air tankers are primary resources in the Victoria, Australia air attack fleet.

These resources take advantage of local short air strips as well as the small inaccessible water sources for helicopters.

Interview Rationale

The questions covered in the field fire supervisor interviews covered the evaluation of basic air attack principles such as drop accuracy, drop effectiveness, turnaround times on multiple drops and the ability of ground forces to follow up on the drops. These are all examples of basic fire management information that the personnel are aware of through their past training, knowledge and experience. All questions asked were within the scope of knowledge that the personnel interviewed possess and utilize on a daily basis in managing wildfires.

DISCUSSION

In reviewing the results of the interviews, it was found that 20 % of the personnel interviewed thought that the central New Jersey air attack program was excellent in its overall effectiveness to deliver water and wetting agents to wildfire incidents. The remaining 80 % expressed that the program performed in a satisfactory manner and there were no poor ratings given. This was the first time in recent history that the actual hands on fire managers were given the opportunity to voice their opinion on how effective the air attack program is

from their perspective. The key factor to remember is that all aviation resources used on a wildfire incident are utilized to support ground based firefighting resources and to make their job easier. Air attack resources can not contain the fire alone and they must work in a coordinated effort under the command of one commander to meet the various challenges offered by wildland firefighting. All supervisors interviewed were pleased with the ability of ground forces to follow up on the aircraft drops with excellent ratings for all three aircraft surveyed. Drop accuracy was rated excellent for the Huey and satisfactory for the single engine air tankers. There may be an issue here dealing with increasing the training of the air tanker operators so that the firefighting operation can coincide with expectations and requirements of the fire managers on the ground who coordinate the use of the aircraft.

The issue of drop effectiveness is a constant unless some type of wetting or suppressing agent is added to the water to make it more effective. This should be a topic of future interviews as well as other forms of research.

Turnaround times were rated excellent for the Huey since it can take advantage of local water sources and return to the its fire suppression assignment within the recognized five minutes. The turnaround time for the single engine air tankers was rated satisfactory. The S.E.A.T.'s utilized in central New Jersey are

well within the 30 mile operating range given by various national sources in the literature review since geographically they can cover the entire central region from within 20 miles of each air attack base and by Division B Fire Control Plan guidelines are limited to a 15 mile operating range. This may require the addition of auxiliary air attack bases closer to the wildfire incident when multiple drops are requested or the use of more than one single engine air tanker per incident.

This research project served as an initial evaluation of the air attack program utilized in the Forest Fire Service's central division and will require continuous monitoring and additional feedback to continue the evaluation of the program and to make any meaningful recommendations in the future on how many of each aircraft should comprise the air attack fleet. However, it is clear that the aviation fleet should consist of a combination of Ag Cat and Dromader single engine air tankers and the Huey drop helicopter.

RECOMMENDATIONS

New Jersey Forest Fire Service policy mandates the dispatch of air attack aircraft to all wildfires within their operating range while the air attack program is operational. This serves to provide for a quick and timely attack of a wildfire and is

aimed to assist the ground based firefighting resources. It is clear that the air attack fleet of the central division of the NJFFS should consist of a combination of single engine air tankers and medium drop helicopters to provide an efficient and effective response to initial attack and large extended attack wildfire incidents.

Joint training programs should be developed between the air attack pilots and the ground based firefighting personnel to increase their knowledge of each other's operating requirements and expectations of each other's capabilities. This type of training could be offered at a joint session annually prior to the beginning of the air attack operational season.

The expanded use of foam, wetting agents and suppressing agents should be explored to increase the effectiveness of all drops made from all three aircraft. A class A foam or some type of wetting agent should be included in each water drop on all wildfire incidents with the strongest urgency for the use on the initial attack wildfire incident.

Aircraft drop and operational reports should be reviewed weekly to ensure that the air attack aircraft are being properly used and if they are not, operational changes can be instituted. Some type of survey should be completed by the field fire supervisors as well as by the air attack pilots at the end of each air attack season to survey their viewpoints on the success

or failure of that year's program.

Finally, it is understood that this evaluation only served as an initial evaluation of the air attack program and more steps need to be implemented to obtain a true and total evaluation. One of the next important steps will be to continuously monitor the changes made during 1999 and expand on their development into the year 2000 and beyond.

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Wildfire,15-16.

Helicopters with buckets (Huey):

How would you rate drop accuracy?

Excellent Satisfactory Poor

How would you rate drop effectiveness?

Excellent Satisfactory Poor

How would you rate the ability of ground forces to follow up on drops?

Excellent Satisfactory Poor

How would you rate turnaround time between multiple drops?

Excellent Satisfactory Poor

Which aircraft is most effective in the following wildfire situations:

Suppressing spot fires?	Huey	S.E.A.T.
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Suppressing initial attack fires?	Huey	S.E.A.T.
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Suppression operations during large wildfires?	Huey	S.E.A.T.
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Air attack is most effective when used as a tool during initial attack.

Agree Disagree Neutral

Air attack is most effective when used as a tool in the suppression of large wildfires.

Agree Disagree Neutral

In general, which of the following would you like to see occur in the air attack program?

Increase the number of Hueys
 Increase the number of Ag Cats
 Increase the number of Dromaders

Which configuration of aircraft would you like to see the Forest Fire Service air attack program utilize:

All Hueys

All Ag Cats

All Dromaders

Combination of Hueys and Ag Cats

Combination of Hueys and Dromaders

Combination of Ag Cats and Dromaders

Combination of Hueys, Ag Cats and Dromaders

APPENDIX B

INTERVIEW RESULTS

Using your most recent fire suppression experience, please answer the following questions in regard to evaluating the current and future air attack program of the New Jersey Forest Fire Service. Results are based on interviews of ten Field Fire Supervisors from the Central Division of the New Jersey Forest Fire Service.

How would you rate the overall effectiveness of the combined air attack program in regard to water and foam delivery on wildfires?

20% Excellent 80% Satisfactory Poor

Single engine air tankers (Ag Cat biplane):

How would you rate drop accuracy?

Excellent 90% Satisfactory 10% Poor

How would you rate drop effectiveness?

20% Excellent 80% Satisfactory Poor

How would you rate the ability of ground forces to follow up on drops?

70% Excellent 30% Satisfactory Poor

How would you rate turnaround time between multiple drops?

Excellent 80% Satisfactory 20% Poor

Single engine air tankers (Dromader):

How would you rate drop accuracy?

Excellent 40% Satisfactory 20% Poor 40% No Comment

How would you rate drop effectiveness?

10% Excellent 40% Satisfactory 10% Poor 40% No Comment

How would you rate the ability of ground forces to follow up on drops?

50% Excellent 10% Satisfactory Poor 40% No Comment

How would you rate turnaround time between multiple drops?

Excellent 50% Satisfactory 10% Poor 40% No Comment

Helicopters with buckets (Huey):

How would you rate drop accuracy?

80% Excellent 10% Satisfactory Poor 10% No Comment

How would you rate drop effectiveness?

50% Excellent 40% Satisfactory Poor 10% No Comment

How would you rate the ability of ground forces to follow up on drops?

70% Excellent 20% Satisfactory Poor 10% No Comment

How would you rate turnaround time between multiple drops?

80% Excellent 1 0% Satisfactory Poor 10% No Comment

Which aircraft is most effective in the following wildfire situations:

Suppressing spot fires? 80% Huey 20% S.E.A.T

Suppressing initial attack fires? 30% Huey 70% S.E.A.T.

Suppression operations during large wildfires? 60% Huey 40% S.E.A.T.

Air attack is most effective when used as a tool during initial attack.

80% Agree Disagree 20% Neutral

Air attack is most effective when used as a tool in the suppression of large wildfires.

20% Agree 50% Disagree 30% Neutral

In general, which of the following would you like to see occur in the air attack program?

- 40% Increase the number of Hueys
- 10% Increase the number of Ag Cats
- 30% Increase the number of Dromaders
- 20% Keep numbers as is!

Which configuration of aircraft would you like to see the Forest Fire Service air attack program utilize:

- All Hueys
- All Ag Cats
- All Dromaders
- 10% Combination of Hueys and Ag Cats
- Combination of Hueys and Dromaders
- Combination of Ag Cats and Dromaders
- 90% Combination of Hueys, Ag Cats and Dromaders

APPENDIX C

AIR ATTACK RESOURCES ASSIGNED TO DIVISION B

(PAST FIFTEEN YEARS / 1984 - 1999)

1984	5	Ag Cats	(SEAT)
1985	5	Ag Cats	(SEAT)
1986	5	Ag Cats	(SEAT)
1987	5	Ag Cats	(SEAT)
1988	5	Ag Cats	(SEAT)
1989	5	Ag Cats	(SEAT)
1990	5	Ag Cats	(SEAT)
1991	5	Ag Cats	(SEAT)
1992	5	Ag Cats	(SEAT)
	1	Jet Ranger	(DROP HELICOPTER)
1993	5	Ag Cats	(SEAT)
	1	Huey	(DROP HELICOPTER)
1994	5	Ag Cats	(SEAT)
	1	Huey	(DROP HELICOPTER)
1995	5	Ag Cats	(SEAT)
	1	Huey	(DROP HELICOPTER)
1996	5	Ag Cats	(SEAT)
	1	Huey	(DROP HELICOPTER)
1997	5	Ag Cats	(SEAT)
	1	Huey	(DROP HELICOPTER)
1998	5	Ag Cats	(SEAT)
	1	Huey	(DROP HELICOPTER)
1999	4	Ag Cats	(SEAT)
	1	Dromader	(SEAT)
	1	Huey	(DROP HELICOPTER)